

**EPA Superfund
Record of Decision:**

**LANGLEY AIR FORCE BASE/NASA LANGLEY
RESEARCH CENTER
EPA ID: VA2800005033
OU 24
HAMPTON, VA
09/25/2000**

Record of Decision

Langley Air Force Base Operable Unit 24

September 2000

RECORD OF DECISION
LANGLEY AIR FORCE BASE
OPERABLE UNIT 24 (OT-06 and OT-06 ANNEX)
DECLARATION

SITE NAME AND LOCATION

Langley Air Force Base

Operable Unit 24 Environmental Restoration Program (ERP) Site OT-06 and OT-06 Annex Hampton, Virginia

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial action for Operable Unit (OU) 24 at Langley Air Force Base (AFB) in Hampton, Virginia, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, 42 U.S.C. §§9601-9675 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300. This decision is based on the Administrative Record for this site.

The Virginia Department of Environmental (VDEQ) concurs with the selected remedy.

DESCRIPTION OF THE SELECTED REMEDY

OU-24 is part of a comprehensive environmental investigation and cleanup currently being performed at Langley AFB under the CERCLA program. This ROD addresses only OU-24 soils; the other OUs located at Langley AFB are being investigated separately under its Environmental Restoration Program and will be addressed in future RODs. Also, this ROD addresses only soils at the OU. The groundwater is being treated as a separate OU (OU-64) and will be addressed on an installation-wide basis.

Langley AFB, the U.S. Environmental Protection Agency (EPA), and VDEQ have determined that no action is necessary for this site. Risk assessment results indicate that OU-24 soils do not pose an imminent or substantial danger to public health, welfare, or the environment.

DECLARATION OF STATUTORY DETERMINATIONS

Risk assessment results from the remedial investigation (RI) performed at OU- 24 indicate that No Action is necessary to be protective of human health and the environment.



DONALD G. COOK

Lieutenant General, USAF

Vice Commander, Air Combat Command



Date



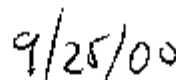
ABRAHAM FERDAS

Director

Hazardous Site Cleanup Division

U.S. Environmental Protection Agency

Region III



Date

RECORD OF DECISION

LANGLEY AIR FORCE BASE

OPERABLE UNIT 24 (OT-06 and OT-06 ANNEX)

September 2000

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List of Acronyms

AFB	Air Force Base
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
EF	degrees Fahrenheit
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FS	Feasibility Study
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IRP	Installation Restoration Program
Langley AFB	Langley Air Force Base
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OU	Operable Unit
PCBs	polychlorinated biphenyls
PCTs	polychlorinated terphenyls
RBSLs	risk-based screening levels
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record Of Decision
SI	Site Inspection
SVOCs	semivolatile organic compounds
VDEQ	Virginia Department of Environmental Quality
VOCs	volatile organic compounds
WWTP	Wastewater Treatment Plant

RECORD OF DECISION
LANGLEY AIR FORCE BASE
OPERABLE UNIT 24 (OT-06 and OT-06 ANNEX)
DECISION SUMMARY

I. Site Name, Location, and Description

Langley Air Force Base (AFB) is located near Hampton, Virginia, which is within the Norfolk metropolitan area, as shown in Figure 1 (Appendix B). The base, which covers 3,152 acres, was established in 1917 and has the distinction of being the oldest continuously active AFB in the United States. The base is situated between the northwest and southwest branches of the Back River, a tidal estuary of the Chesapeake Bay. Langley AFB was proposed to be included on the National Priorities List (NPL) in 1993 and finalized in 1994. This NPL includes sites where uncontrolled hazardous substance releases may potentially present serious threats to human health and the environment. Operable Unit (OU)-24 was one of the Environmental Restoration Program (ERP) [formerly Installation Restoration Program (IRP)] sites investigated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at Langley AFB and was initially designated ERP (formerly IRP) Site OT-06 and Site OT-06 Annex.

The Air Force and the United States Environmental Protection Agency (EPA) are the lead agencies involved in the remedial process for Site OT-06 and OT-06 Annex. The Virginia Department of Environmental Quality (VDEQ) serves as a support agency. The National Superfund Database identification number for Langley AFB is VA2800005033. Funds required for remediating Site OT-06 and OT-06 Annex originate from the Environmental Restoration Account.

The site consists of the former locations of an entomology (pest control) building and a wastewater treatment plant (OT-06), and the former location of an antenna field (OT-06 Annex). The locations of these areas at Langley AFB are shown in Figure 2. The areas are located within the Shellbank Area in the southern portion of the base. The areas surrounding OT-06 are comprised of open space, the B-52 monument and a billeting area. The areas

surrounding the OT-06 Annex are comprised of open space and recreational areas (ballfields). A description of the two areas taken from the Remedial Investigation (RI) report¹ is provided in the following section.

A. OT-06

Site OT-06 is the site of a former entomology building and the Shellbank wastewater treatment plant (WWTP). According to historical records, the chemicals used at the former entomology building included chlordane, DDT, dieldrin, gamma-BHC (lindane) and malathion. The entomology building was constructed in the early 1940s and was demolished in the 1960s. Site OT-06 was also identified as the disposal site for WWTP sludge. The WWTP began operations in 1942, and was taken out of service and demolished in 1968.

Aerial photographs of Site OT-06 dated 1942, 1944, 1953, 1959, and 1962 show buildings and structures believed to be the entomology building and the WWTP. Figure 3 shows a composite of historical land-use maps prepared from an analysis of these historical aerial photographs. Figure 4 shows locations where soil samples were collected during the RI.

B. OT-06 ANNEX

Site OT-06 Annex was proposed as the site for a Child Development Center. However, during pre-construction activities conducted in 1995, samples of soil were obtained for laboratory analysis and were shown to contain elevated levels of pesticides, polynuclear aromatic hydrocarbons and metals. These data prompted the inclusion of the OT-06 Annex Study Area into the remedial investigation/feasibility study (RI/FS) for Site OT-06. Analysis of historical aerial photographs shows that the Site OT-06 Annex area consisted of open space prior to the 1960s. During the 1960s, this area was the location of an antenna field (Figure 3). After the antenna field was removed, the area was once again used as open space. Figure 4 shows locations where soil samples were collected during the RI.

II. Site History

This section describes the history of waste disposal in addition to actions taken in response to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigations at Operable Unit (OU)-24.

A. History of Waste Disposal

The mission of Langley AFB has changed during its history. To support its missions, the base has conducted a variety of activities including operation of entomology facilities, wastewater treatment facilities and antenna fields. In the past, an entomology building and wastewater treatment facilities were operated at OT-06 and an antenna field was operated at the Annex. The entomology building, operated from the early 1940s until 1960, supported pest control operations in portions of the base and was the site of pesticide formulation, equipment cleaning, and maintenance. The wastewater treatment plant provided treatment to wastewater generated by various facilities at Langley AFB from 1942 to 1968. The Annex was the location of several large antennas during the 1960s. No interim actions have been performed at this OU.

There are currently 23 other OUs being investigated at Langley AFB. Table 1 (Appendix A) provides a brief summary of these OUs.

B. CERCLA Investigations

Three CERCLA investigations have been performed at the OU. The OU was originally identified during the 1981 Installation Restoration Program (IRP) records search but was not recommended for investigation at that time.² The IRP was later redesignated as the Environmental Restoration Program (ERP). The area evaluated during this effort included Site OT-06, but did not include the Annex. The second investigation was the Site Inspection (SI) and screening risk assessment.³ The report resulting from this investigation was used to determine the presence or absence of contamination at OT-06 (not including the Annex) resulting from past waste disposal practices. These results were used in a screening risk assessment³ as part of the SI report. The screening level risk assessment evaluated the risks to potential future residents and workers associated with dermal contact and ingestion of contaminated soil and groundwater. The SI indicated that chemicals of potential concern (COPCs) at Site OT-06

included pesticides, semivolatile organic compounds (SVOCs) and metals. Also, some of the ecological COPCs were identified as having high bioconcentration and biomagnification potential. The SI report concluded that additional investigation was warranted and recommended that a RI/FS be performed for the site.

The third CERCLA investigation was the RI.¹ The RI was performed to further characterize potential environmental contamination from OU-24 and to conduct baseline human health and ecological risk assessments. The Site OT-06 Annex was identified as a result of preconstruction soil sampling associated with the planned establishment of a child development center at the location of the annex. Sample results indicated that the concentrations of several chemicals exceeded screening levels developed for the potential future use as a child development center. Based on this information, the area was added to the Site OT-06 RI/FS for further investigation. The results of the RI indicated that OU-24 does not pose an unacceptable risk to human health or the environment.

III. Highlights of Community Participation

In accordance with Sections 113 and 117 of CERCLA, 42 U.S.C. Sections 9613 and 9617, Langley AFB, in conjunction with the U.S. Environmental Protection Agency (EPA) and the Virginia Department of Environmental Quality (VDEQ), issued a *Proposed Plan* on May 15, 2000, presenting the preferred remedial alternative for OU-24.⁴ The *Proposed Plan* and the supporting documentation were made available for review at that time and are among the documents which comprise the CERCLA Administrative Record for the OU.

The Administrative Record is available for review by the public at the following information repositories:

- Hampton Public Library
Reference Section, Langley AFB Information Repository
4207 Victoria Boulevard
Hampton, Virginia 23669
(757) 727-1154

- Langley AFB
Administrative Record Room
Contact: Mr. Vern Bartels
37 Sweeney Blvd.
Building No. 328
Langley AFB, Virginia 23665-2107
(747) 764-1046

An announcement for a public meeting, the comment period, and the availability of the *Proposed Plan* and supporting documentation was published in the *Daily Press*, a newspaper of general circulation in Hampton, VA, on May 14, 2000. Additionally, this information was published in the Flyer, a Langley Air Force Base newspaper on May 14, 2000. This meeting was also announced at the previous Restoration Advisory Board Meeting, held June 1, 2000.

The public comment period for the *Proposed Plan* was from May 15, 2000 to June 12, 2000. A public meeting was held at the Virginia Air and Space Center's Library in Hampton, Virginia, on June 1, 2000 to inform the public of the proposed no action alternative and to seek public comment. At this meeting, representatives from Langley AFB, EPA, and VDEQ were available to answer questions about conditions at OU-24 and the no action proposal for the soils. Responses to the comments received during this period are included in Section VIII (Responsiveness Summary) of this Record of Decision (ROD).

This ROD presents the remedial action for OU-24 which was selected in accordance with CERCLA and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). All documents considered or relied upon in reaching the remedy selection decision contained in this ROD are included in the Administrative Record for the OU and can be reviewed at the information repositories.

IV. Scope and Role of Operable Unit

OU-24 is one of the ERP sites currently being investigated under CERCLA at Langley AFB. Discrete portions of an NPL site are often managed more effectively as Operable Units. This ROD addresses OU-24, which is the ERP Site OT-06 and OT-06 Annex soil OU. The remaining OUs at Langley AFB are currently being independently investigated under CERCLA (Table 1).

Risks to human health and the environment from soil at OU-24 have been evaluated, and this ROD presents the No Action proposal recommended based on risk assessment results. The RI report, which includes the human health and ecological risk assessments, documents the findings associated with OU-24. On the basis of these findings, Langley AFB, EPA and VDEQ have determined that the site does not pose an unacceptable risk to human health and the environment. The risk calculated under the current and future land use scenarios is below or within EPA's acceptable risk range.

Langley AFB, with the support of EPA and VDEQ, recommends that No Action is necessary at the Site to protect human health and the environment. Under the No Action alternative, no remedial action will be taken at OU-24. This is the planned response action for this OU. The EPA and VDEQ concur with the No Action alternative proposed by Langley AFB.

This document is the result of a Langley Partnership Team effort. The Langley Partnership is the ERP decision-making body and is composed of representatives from EPA Region III, VDEQ, the U.S. Air Force Air Combat Command, Langley AFB, the U.S. Army Corps of Engineers, and environmental consultants. Several decisions on how work is to proceed at Langley AFB have been made by the team and have been documented. These signed agreements, or consensus agreements, are available for review in the Administrative Record.

This ROD describes the no action alternative selected for OU-24. Only the soil at OU-24 is addressed in this document. The groundwater at OU-24 is being investigated separately under CERCLA and will be addressed in a future ROD.

V. Summary of Site Characteristics and Extent of Contamination

Summarized below are the relevant findings of the work to date focusing on contaminated soil located within the boundaries of OU-24. The Conceptual Site Model (CSM) illustrating the contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human health and ecological receptors are included as Figures 5a, 5b and 6.

A. Site Characteristics

The current land use of both OT-06 and the OT-06 Annex is open space. The areas surrounding OT-06 are comprised of open space, the B-52 monument, and a billeting area. The areas surrounding the OT-06 Annex are comprised of open space and recreational areas (ballfields). The land use of these areas is likely to remain the same; the OU is unlikely to be used for future residential use. However, the risk assessment conducted as part of the RI evaluated both recreational and residential human receptors should the current land use of the OU change.

The information below describes the soil and groundwater resources present at OU-24.

1. Geology and Hydrogeology

This description is based on information in the Langley AFB Conceptual Hydrogeological Model Report⁵. The near-surface geology at Langley AFB consists of a minor thickness of top soil and fill that overlies unconsolidated coastal plain sediment. Groundwater is present in the subsurface throughout York County in several water-bearing zones. The shallowest groundwater-bearing zone consists of the York County Shallow aquifer system, which is comprised of the Columbia Aquifer, the Cornwallis-Cave Confining Unit, the Cornwallis-Cave Aquifer, the Yorktown Confining Unit, and the Yorktown-Eastover Aquifer. None of these aquifers are used as sources of drinking water for Langley AFB because saltwater intrusion from the nearby Back River causes very high chloride concentrations in the groundwater. Even though the groundwater in this area is not used as a source of drinking water, individual homeowners have groundwater wells that have been used for watering lawns and washing cars.

The upper three units of the York County Shallow Aquifer system (the Columbia Aquifer, the Cornwallis-Cave Confining Unit, and the Cornwallis-Cave Aquifer) are considered at Langley AFB to be one unit, the Water Table Aquifer. This is based on the examination of geophysical logs and cores from boreholes drilled at numerous locations at Langley AFB, which indicate the Cornwallis-Cave Confining Unit is discontinuous; therefore, the Columbia and Cornwallis Cave aquifers directly overlay in places. The upper part of the Water Table Aquifer consists of the Tabb Formation, and the lower part of the Water Table Aquifer consists of the uppermost portion of the Yorktown Formation. The Water Table Aquifer consists of approximately 70 feet of clayey silt and silty clay, which locally contains shells.

The Yorktown Confining Unit, which lies below the Water Table Aquifer, is defined as the silty clay Morgarts Beach Member of the lowermost Yorktown Formation. The Yorktown Confining Unit consists of 3 to 15 feet of dense clay, which is typically present at a depth of approximately 70 feet below ground surface (bgs). The Yorktown Confining Unit is regionally extensive; it is present at all borehole locations at Langley AFB drilled to a depth greater than 75 feet.

The Yorktown-Eastover Aquifer lies below the Yorktown Confining Unit. This aquifer consists of between 10 and 70 feet of sandy and shell-rich sediment of the lower Yorktown Formation and the upper Eastover Formation. Groundwater within the Yorktown-Eastover Aquifer is generally under artesian flow, as indicated by the observation that groundwater from wells screened within this unit is encountered at depths higher than the top of the unit equivalent to those in the Water Table Aquifer.

The Eastover-Calvert Confining Unit, which lies below the Yorktown-Eastover Aquifer, consists of a regionally extensive, dense, silty clay with an approximate thickness of 125 to 360 feet.

2. Meteorology

The climate at OU-24 is influenced by the Chesapeake Bay and the Atlantic Ocean to the east, and by the mountains to the west. Mild winters and warm, humid summers are the norm. Wintertime temperatures range from 30°F to near 50°F; summertime temperatures range from approximately 70°F to 90°F. Precipitation at OU-24 is greatest in July and in August, with minimum amounts in November and April; the annual average is 44.15 inches. In a given month, precipitation falls from 7 to 11 days on average. In a given year, precipitation occurs during an average of approximately 110 days. Snowfall averages 10 inches per year, but is highly variable, ranging from 0 to 45 inches.

With an average wind speed of roughly 5 to 8 knots, the prevailing winds are south-southwest in April through May, southwest in June through September, and north in October through March.

3. Ecology

Presently, both OT-06 and the OT-06 Annex areas are well-maintained grass lawns. The limited size of the areas (less than 5 acres each) and the altered nature of the vegetation cause these areas to be relatively low quality ecological habitat. This ROD considers only the terrestrial habitat at OT-06 and the Annex. The aquatic habitat associated with shorelines of the Back River, Tide Mill Creek, and the adjacent wetlands is located several hundred feet from Site OT-06 and the Annex.. These surface water bodies are not directly associated with the terrestrial habitat at the site and are being evaluated as part of a RI (SS-63) being conducted to evaluate chemicals in sediment along portions of the shoreline of the Back River. The level of human activity at and near the OU reduces the quality of this area as habitat for ecological receptors. However, small mammals (e.g., voles and mice) and passerine birds may use the area to forage for seeds and invertebrates at the OU.

4. Soils

Soils occurring at the surface consist of silty, clayey sands, with a low to moderate permeability.

OU-24 is flat and covered with vegetation (i.e., grasses) that would prevent contaminant migration via wind-blown dust and surface runoff.

B. Nature And Extent Of Contamination

The SI consisted of drilling ten soil borings and collecting 20 soil samples at OT-06. The RI consisted of drilling 121 soil borings and collecting 252 soil samples at OT-06 and drilling 54 soil borings and collecting 108 soil samples at the Annex. The RI data received Level IV data validation and therefore was used in a baseline risk assessment for OU-24. The following is a summary of the sampling results of these investigations. Because this ROD specifically addresses the soil at OU-24, only the soil results are presented below.

1. Site OT-06

During the SI, ten soil borings were completed at OT-06. Soil boring activities were not conducted at the Annex during the SI. Two soil samples were collected from each borehole. One sample from each borehole was collected near the ground surface (one to three feet and a second sample was collected from just above the water table. These samples were analyzed for metals, polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), chlorinated herbicides, semi-volatile organic compounds (SVOCs), cyanide, sulfide and phenolics. The screening assessment identified selected metals, SVOCs and pesticides as the COPCs for both human and ecological receptors at OT-06.

For the RI, 121 soil borings, were completed at OT-06. A surface soil sample (ground surface to six inches) was collected from each boring as well as from 10 additional locations at Site OT-06 for a total of 131 samples. Subsurface soil samples were collected from each of the 121 borings. In 111 of the borings, a single subsurface composite soil sample was collected from a depth of six inches bgs to the water table (approximately four feet). In the remaining ten borings, three discrete subsurface soil samples were collected for a total of 141 samples. Figure 3 shows the locations of the soil samples. The samples were analyzed for metals, cyanide, volatile organic compounds (VOCs), SVOCs, PCBs, pesticides and herbicides and received Level IV data validation.

Both surface and subsurface soil samples from OT-06 contained concentrations of selected pesticides, SVOCs and metals which exceeded human health screening levels and background levels. These analytes were considered COPCs and were evaluated in the human health and ecological risk assessments performed as part of the RI. Dieldrin, aldrin and benz(a)pyrene were the COPCs which were present in surface and subsurface soil at concentrations exceeding screening levels over a larger portion of the site than other COPCs.

2. Site OT-06 Annex

The Site OT-06 Annex was not included in the SI performed for multiple ERP sites at Langley AFB. The Annex was identified as a result of pre-construction soil sampling associated with the planned establishment of a child development center at the location of the Annex in 1995. Sample results indicated that the concentrations of several chemicals exceeded screening levels developed for the potential future use as a child development center. Based on this

information, the area was added to the OT-06 RI/FS for further investigation.

Samples from the 54 soil borings drilled during pre-construction activities were used in the RI. A surface soil sample (ground surface to three inches deep) and a subsurface soil sample (just above the water table, two to five feet deep) were collected from each boring. The samples were analyzed for pesticides, herbicides, PCBs, VOCs and SVOCs. These samples received Level IV data validation prior to consideration in the RI.

Both surface and subsurface soil samples from the OT-06 Annex contained concentrations of selected pesticides, SVOCs and metals which exceeded human health screening levels and background levels. These analytes were considered COPCs and were evaluated in the human health and ecological risk assessments performed as part of the RI. Dieldrin and benz(a)pyrene were the COPCs which were present in surface soil at concentrations exceeding screening levels over a larger portion of the site than other COPCs. Arsenic and iron were most frequently present in subsurface soil at concentrations exceeding screening levels.

3. Contaminant Fate and Transport

Fate and transport modeling was performed at OU-24 to determine the mass of airborne particulate matter and sorbed chemicals likely to be inhaled by various potential receptors at the OU.

Groundwater fate and transport modeling was also conducted for OU-24 in the RI. Since this ROD addresses only soil for OU-24, groundwater fate and transport modeling results will be presented in the ROD addressing basewide groundwater.

VI. Current and Potential Future Site and Resource Uses

Current land use at both Site OT-06 and the Annex is open space. Future land use is expected to remain open space. There are currently no restrictions regarding land use at the sites, such as fences and signs. Land adjacent to OT-06 and the Annex is currently commercial (billeting area), open space and recreational. Future adjacent land use is expected to remain the same.

VII. Summary of Site Risks

A risk assessment was conducted in the RI in accordance with the latest EPA policy on risk assessments.⁶ This risk assessment was submitted to EPA Region III and comments regarding the human health risk assessment were received from EPA Region III. These comments included an independent recalculation of the risk to all receptors. The recalculation of risk which was included as part of the EPA review incorporated information which became available after the draft risk assessment was prepared and before the EPA review was conducted. This information included a basewide background soil database⁷ which was approved by the Langley Partnership for use in all risk assessments at Langley AFB. The background dataset is used to determine which chemicals have resulted from activities at the site and which chemicals occur naturally. The draft human health risk assessment (HHRA) originally submitted to EPA used background soil data obtained from samples collected exclusively from the site because a basewide background dataset was not available.

The EPA review also incorporated more recent toxicity criteria. These criteria are continually being updated as additional data from scientific literature become available. Changes to toxicity criteria can impact whether chemicals are considered to be of concern and evaluated in the risk assessment as well as the estimated risk attributed to each chemical.

The differences in the risk estimates included in the human health risk assessment and those provided in the EPA comments were evaluated in detail. It was agreed that the calculations provided by EPA as part of their comments on the risk assessment incorporated the most recent technical information and represented a refinement over the risk estimate presented in the RI report. The Langley Partnership agreed that the updated risk estimates prepared by EPA should be used as the basis for decisions concerning any proposed action at the site and that the document containing these risk estimates should be incorporated into the RI report as an appendix. The estimates of risk prepared by EPA are included in Appendix B of the RI report. As agreed by the Langley Partnership, risk estimates used to determine the need for action at the site (and referred to in this document) are those calculated by EPA and presented in Appendix B of the RI report. The results of the risk assessment, including the comments and calculations provided by EPA Region III, are summarized below.

A. Human Health Risk Assessment

Health risks are based on a conservative estimate of the potential carcinogenic risk or potential to cause other health effects not related to cancer. Carcinogenic risks and non-carcinogenic risks were evaluated as part of the risk assessment. The following three factors were considered:

1. Nature and extent of contaminants at the OU;
2. The exposure pathways through which human and ecological receptors are or may be exposed to those contaminants at the OU; and
3. Potential toxic effects of those contaminants.

For OU-24, surface water and sediment samples were collected from the Back River and Tide Mill Creek. These data are not evaluated in this ROD because the aquatic habitat in these waterbodies is not directly related to OT-06 or the Annex. Surface water data, sediment data, and the potential impact to aquatic receptors will be addressed in a RI which addresses potentially-contaminated sediment in the Back River (SS-63). Groundwater was addressed for the human health receptors, but groundwater results will be presented in a separate ROD.

Health risk levels, determined using EPA guidance to ensure that conservative estimates of potential health effects are determined, differ depending on the assumed land use because the level of human exposure differs with land use. A conservative estimate of risk was developed, incorporating the potential exposure pathways of direct skin contact with contaminated soil, accidental ingestion of soil, and inhalation of contaminated soil particles. Plausible receptors that may be exposed to soil at the site were identified for current land use and plausible future land uses. Current land use is based on the assumption that the property will remain under government control and will continue to be used as open space. Several future land use scenarios were evaluated for the site including use as a child development center, an extension of the adjacent billeting facility, a playground and recreational fields. Exposure of workers involved in potential future construction activities to chemicals in soil was also evaluated. The human health risk assessment also evaluated residential receptors to provide a conservative estimate of risk in the unlikely event that the site might be developed for residential use. Table 2 presents the equations and exposure parameters used to calculate risk levels for these

receptors.

Carcinogenic risks are expressed as numbers reflecting the increased chance that a person will develop cancer, if he is directly exposed (e.g., working at the OU) to the contaminants found in the soil over a period of time. For example, EPA's acceptable risk range for cancer is 1×10^{-4} to 1×10^{-6} , meaning there is one additional chance in ten thousand (1×10^{-4}) to one additional chance in one million (1×10^{-6}) that a person will develop cancer if exposed to a hazardous waste site.

The risk associated with developing other health effects is expressed as a hazard index (HI) which is the ratio of the existing level of exposure to contaminants at a site to an acceptable level of exposure. Below a hazard index of 1, adverse effects are not expected. Noncarcinogenic chemicals typically cause adverse effects by disrupting the function of a specific body system or organ. For example, one chemical may cause kidney failure while others may impact the liver, skin or respiratory tract. The effects of these chemicals attacking various organs are independent and their associated HI values are not additive unless they attack the same target organ. For this reason, when the total HI for a receptor exceeds 1.0, the risk is often divided among the various organs which are affected by the COPCs.

Concentrations of chemicals detected in the soil during the RI were compared to Risk-Based Screening Levels (RBSLs) and background levels. RBSLs have been developed by EPA Region III to allow chemicals which do not contribute significantly to the risk at a site to be eliminated early in the risk assessment process. This allows the majority of the risk assessment effort to be focused on the COPCs. Chemicals that exceeded the RBSLs or were statistically greater than background concentrations were then used to calculate site-related risk.

Chemicals responsible for a significant portion of the risk attributable to surface soil at OT-06 were arsenic, iron, chromium, mercury and dieldrin. Of these, only mercury and dieldrin were present at concentrations significantly greater than background levels. Consequently, the detected concentrations of mercury and dieldrin in surface soil were attributed to activities at the site. For subsurface soil, chemicals responsible for a significant portion of the risk were aluminum, arsenic, iron, manganese and dieldrin. Only dieldrin was present at a concentration significantly greater than its background level. Table 3 presents COPCs for surface and subsurface soil. For the OT-06 Annex, chemicals responsible for a significant portion of the

risk attributable to surface soil were arsenic, chromium and iron. None of these chemicals were present at concentrations significantly greater than background levels. Consequently, none of these chemicals were considered to be related to activities at the site. For subsurface soil, chemicals responsible for a significant portion of the risk were aluminum, arsenic, iron and manganese. None of these chemicals were present at concentrations significantly greater than background levels and none were considered to be associated with site activities.

Table 4 presents the risk results for the human health risk assessment for OT-06 and the Annex. The human health risk assessment concluded that the lifetime cancer risks from exposure to site-related chemicals in surface soil at Site OT-06 for the nine receptors evaluated in the risk assessment ranged from 4×10^{-5} to 2×10^{-7} . These lifetime risk estimates are either below or within EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6} .

The HI for the noncarcinogenic: risks due to exposure to site-related chemicals in surface soil at Site OT-06 for the nine receptors evaluated in the risk assessment ranged from 0.01 to 1.1. The HI of 1.1 represented the sum of HI values calculated for all individual COPCs without consideration of the target organs which these chemicals impact. When the HI values were recalculated such that the risk was distributed among the target organs associated with each COPC, the maximum HI was 0.7 based on effects to the liver. These noncarcinogenic risk estimates (when adjusted for target organs) are below EPA's acceptable level of 1.0, which indicates that adverse noncarcinogenic health effects are unlikely to develop as a result of exposure to any of the nine receptors through any of the exposure pathways.

Lifetime cancer risks from exposure to site-related chemicals in surface and subsurface soil were determined to be negligible for all receptors at the Site OT-06 Annex. These lifetime risk estimates are below EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6} . The HI values for the noncarcinogenic risks due to exposure to site-related chemicals in surface and subsurface soil at the Site OT-06 Annex were also negligible except for future residents. Future resident HI values were 0.5 and 0.2 for the child and adult, respectively. These values are below the acceptable level of 1.0, which indicates that adverse noncarcinogenic health effects are unlikely to develop as a result of exposure through any of the exposure pathways.

B. Ecological Risk Assessment

The ecological risk assessment evaluated exposure of terrestrial receptors to soil. Both OT-06 and the OT-06 Annex are limited in size (approximately 5 acres each) and are maintained grass lawns which provide only limited ecological habitat. No surface water or sediment exposure pathways exist within the boundaries of the Site.

Hazard quotients (HQs) calculated using toxicity criteria from site-specific testing and current scientific literature were less than 1.0 for all receptors evaluated including the robin, red-tail hawk, fox, earthworm and deer mouse for both OT-06 and the Annex. These results indicate that remedial action is not required to protect any of the receptors evaluated.

After the evaluation of the human health and ecological risk assessment, the Partnership concluded that the contamination found in the surface and subsurface soils at the site does not pose unacceptable human health or ecological risks. Therefore, conditions at this site are deemed to be already protective of human health.

C. Conclusions

After evaluating the RI human health and ecological risk assessments, no action is considered necessary to protect human health and the environment at OU-24. The cancer risk calculated under the current and future land use scenarios for OT-06 is within EPA's acceptable risk range, and cancer risk estimates for the Annex are below the EPA's acceptable risk range. Any adverse non-carcinogenic health effects are also unlikely to develop from the site as a result of exposure through any of the exposure pathways. Ecological risk assessment determined that there is minimal risk to terrestrial receptors at the site.

Langley AFB, EPA and VDEQ have selected no action as the preferred alternative for soil at OU-24; under this alternative, no remedial action would take place. The selection of no action is based on the conclusion, reached by the human health and ecological risk assessments, that the soil at the two areas comprising OU-24 pose no significant risk to potential human or ecological receptors. No action, therefore, would be protective of human health and the environment.

Following review and consideration of the information in the Administrative Record, the requirements of CERCLA and the NCP, and public comments received on the Proposed Plan, Langley AFB, EPA and VDEQ have selected the no action alternative as the remedy for OU-24.

VIII. Significant Changes from Proposed Plan

No changes were made from the *Proposed Plan* as a result of public review during the comment period or public meeting.

IX. Responsiveness Summary

A. Overview

In the *Proposed Plan* released for public comment on May 15, 2000, Langley AFB and EPA, with the support of VDEQ, identified no action as the preferred remedial alternative for OU-24. The no action alternative is described in the “Summary of the Proposed Remedy” in the *Proposed Plan*.

There were no written comments received during the public comment period. There were no written comments submitted during the June 1, 2000 public meeting. There were no questions presented orally at the public meeting concerning OU-24. A brief description of community involvement to date is provided below.

B. Community Involvement to Date

Langley AFB, EPA, and VDEQ established a public comment period from May 15, 2000 to June 12, 2000 for interested parties to comment on the *Proposed Plan*. The plan and all other documents considered or relied upon during the remedy selection process for the no action alternative are included in the Administrative Record, which is available for public review. A public meeting was held at the Virginia Air and Space Center, Hampton, Virginia, on June 1, 2000 to present the proposed plan, answer questions, and accept both oral and written

comments on OU-24. Two people attended the public meeting but none commented on the Proposed Plan.

A responsiveness summary, required by CERCLA, provides a summary of citizen comments made during the public meeting and the responses of Langley AFB, EPA, and VDEQ. A responsiveness summary was not prepared because no comments were received.

C. Summary Of Comments Received During Public Comment Period and Comment Responses

In the public meeting held on June 1, 2000, two proposed plans for Langley AFB were presented. One was for OU-24 (ERP Site OT-06 and OT-06 Annex), and the other was for OU-31 (ERP Site LF-13). No comments were received pertaining to OU-24 during the public meeting or the public comment period.

APPENDIX A

Tables

**Table 1. Summary of Operable Units Under CERCLA Investigation
Langley Air Force Base, Virginia**

Page 1 of 2

OU Name/IRP Site Name	Findings	Current Status
OU-21/LF-01 Former Landfill, End of 08/26 Runway	Contaminants of Potential Concern (COPCs) - pesticides and metals in the groundwater and soil.	In the remedial investigation (RI)/feasibility study (FS) phase. A draft final RI report has been submitted and reviewed. A FS is in progress.
OU-22/WP-02 Former Waste Water Treatment Plant, Bldg. 724	COPCs - pesticides and metals in the groundwater and soil.	In the RI phase. A draft RI report was submitted in April 2000.
OU-23/LF-05 Former Landfill in the Shellbank Area	COPCs - pesticides, volatile organic compounds (VOCs), and metals in the groundwater; pesticides and metals in the surface water; and semivolatile organic compounds (SVOCs) and metals in the soil.	In the RI/FS phase. A draft final RI report has been submitted and reviewed. A FS was submitted in May 2000.
OU-24/OT-06 Former Entomology Site, Shellbank Area	COPCs - pesticides, VOCs, SVOC, and some metals in the groundwater; SVOCs, pesticides and some metals in the soil.	In the ROD phase.
OU-25/LF-07 Former Landfill, Shellbank Area	COPCs - pesticides and some metals in the groundwater; dieldrin in the soil.	In the RI/FS phase. A final RI report was submitted in May 2000. A FS was submitted in April 2000.
OU-26/WP-08 Former Waste Water Treatment Plant, Lighter Than Air (LTA) Area	COPCs - some pesticides and metals in the groundwater; dieldrin in the soil.	In the RI/FS phase. A draft-final RI report submitted January 2000. A FS is in progress.
OU-28/LF-10 Former Landfill, Golf Course	COPCs - VOCs, metals and some pesticides in the groundwater; VOCs and polychlorinated biphenyls (PCBs) in surface water; some metals in the soil.	In the RI/FS phase. A final RI report was submitted in May 2000. A FS was submitted in April 2000.
OU-29, LF-11 Former Landfill, Tabbs Creek Area	COPCs - VOCs, pesticides, metals and PCBs in the groundwater; some metals in the surface water; SVOCs, metals, and PCBs in the soil.	In the RI/FS, phase. A final RI report was submitted in May 2000. A FS was submitted in April 2000.
OU-30/LF-12 Former Landfill, Munitions Storage area, Northwest Area of Base	COPCs - VOCs and metals in the groundwater; metals and 2,4 DB in the surface water; SVOCs and nickel in the soil.	In the RI/FS phase. A final RI report was submitted in May 2000. A FS was submitted in April 2000
OU-31/LF-13 Former Landfill Munitions Storage Area, Northwest Area of Base	COPCs - Aldrin, alpha-BHC and some metals in the groundwater; VOCs, SVOCs, metals and PCBs in the surface water.	In the ROD phase.
OU-32/WP-14 Former Chemical Leach Pit, Firing-In Abutment, Building 1303	COPCs - pesticides, SVOCs, and some metals in the groundwater; arsenic and dieldrin in the soil.	In the RI/FS phase. A final RI report scheduled for summer 2000. A FS is in progress.
OU-33/LF-15 Former Landfill, Willoughby Point	COPCs - VOCs, SVOCs, pesticides and metals in the groundwater; pesticides and metals in the surface water.	In the RI/FS phase. A draft final RI report has been submitted and reviewed. A FS was submitted in May 2000.
OU-34/LF- 17 Former Landfill, LTA Area	COPCs - VOCs, pesticides and some metals in the groundwater; dieldrin and some metals (mainly lead) in the soil	In the RI phase. A draft RI report was submitted in April 2000 and is in review.

**Table 1. Summary of Operable Units Under CERCLA Investigation
Langley Air Force Base, Virginia (Continued)**

Page 2 of 2

OU Name/IRP Site Name	Findings	Current Status
OU-35/LF-18 Former Landfill, Northwest corner of Base	COPCs - pesticides in the groundwater; pesticides and metals in the surface water; SVOCs and manganese in the surface soil; delta-BHC, and metals in the sediment.	In the RI/FS phase. A draft final RI report has been submitted and reviewed. A FS was submitted in May 2000.
OU-37/LF-22 Former Landfill, Willoughby Point	COPCs - pesticides and metals in the groundwater; alpha-BHC, delta-BHC and metals in the surface water.	In the RI/FS phase. A draft final RI report has been submitted and reviewed. A FS was submitted in May 2000.
OU-40/OT-25 Old Entomology Building and Former Storage Area, Bldg. 965	COPCs - pesticides in the groundwater and soil.	In the RI/FS phase. A draft RI report has been submitted and reviewed. The document is being revised in response to the comments.
OU-42/OT-38A and B Four Waste Oil and Trash Burn Areas Basewide	Risk assessments showed no significant risk to human health or the environment from soils	The ROD was signed in January 1999.
OU-44/FT-41 Former Fire Training Area, Firing-In Abutment, Bldg. 1303	COPCs - VOCs, pesticides, dioxins, and some metals in the groundwater; SVOCs, dioxins and some metals in the surface water.	In the RI/FS phase. A draft final RI report has been submitted and reviewed. A FS was submitted in May 2000.
OU-47/OT-51 Former Electrical Substation, Shellbank Area. Bldg. 82	COPCs - pesticides, PCBs and lead in the soil.	The ROD was signed in January 1999.
OU-48/OT-55 Civil Engineering Yard, Underground Petroleum Contamination	COPCs - pesticides and dieldrin in the groundwater; pesticides and PCBs in the soil.	In the RI phase. A draft RI report was submitted in June 2000 and is in review.
OU-49/OT-56 Silver Contamination in Storm Sewers, Basewide	COPCs - metals and VOCs in surface water and metals, SVOCs and pesticides in sediment.	The final Phase II ecological risk assessment report was submitted in July 2000.
OU-50/SS-61 Old Civil Engineering Paint Shop/Marina	COPCs - VOCs in the groundwater and soil.	The ROD was signed in September 1999. The Memorandum of Agreement on Land-Use Controls have been submitted and is in review.
OU-51/SS-63 Back River Sediments	COPCs - pesticides, metals, and PCTs in the sediment.	In the RI/FS stage. The draft work plan was submitted in June 2000.
OU-52/OT-64 Groundwater Contamination, Basewide	COPCs - pesticides and metals in the groundwater.	In the planning phase. The final single-sampling events work plan was submitted in June 2000. The revised draft long-term monitoring work plan was submitted in July 2000.

**Table 2a. Exposure Equations and Assumptions for Dermal Exposure
Langley Air Force Base**

The dermal absorption intake of chemicals in surface and subsurface soil was generated using the following equation:

$$\text{Intake (mg/kg/day)} = \frac{C \times 10^{-6} \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

C	=	Representative concentration of the contaminant in soil (mg/kg)
SA	=	Exposed surface area of the skin (cm ² /events)
AF	=	Adherence factor (mg/cm ²)
ABS	=	Absorption fraction of the chemical (unitless)
EF	=	Exposure frequency (events/year)
ED	=	Exposure duration (yrs)
BW	=	Receptor body weight (kg)
AT	=	Averaging period (days)
10 ⁻⁶	=	Conversion factor (kg/mg)

The input variables that were used to estimate the dermal exposure to each potential receptor, along with the justification for their use, are provided below.

Input Parameter		Child at Playground	Adult in Billeting Area	Child in Billeting Area	Maintenance Worker	Child Ballplayer	Child in Daycare	Construction Worker	Child Resident	Adult Resident
Soil to skin adherence factor (AF)	Avg.	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)
	RME	1.0 mg/cm ² (2)	1.0 mg/cm ² (2)	1.0 mg/cm ² (2)	1.0 mg/cm ² (2)	1.0 mg/cm ² (2)	1.0 mg/cm ² (2)	1 mg/cm ² (2)	0.2 mg/cm ² (1)	0.2 mg/cm ² (1)
Exposure frequency (EF)	Avg./RME	250 events/ year (3)	365 events/ year 4	365 events/ year 4	52 events/ year (5)	48 events/ year (6)	250 events/ year (7)	250 events/ year (8)	350 events/ year (27)	350 events/ year (27)
Exposure duration (ED)	Avg.	3 years (9)	0.08 years (10)	0.08 years (10)	5 years (1)	3 years (12)	3 years (13)	0.04 years (14)	1.8 years (30)	9 years (30)
	RME	5 years (15)	0.25 years (16)	0.25 years (16)	25 years (8)	5 years (17)	5 years (18)	0.2 years (19)	6 years (30)	24 years (30)
Body Weight (kg)	Avg./RME	1.5 kg (8)	70 kg (8)	15 kg (8)	70 kg (8)	36 kg (20)	15 kg (8)	70 kg (8)	15 kg (8)	70 kg (8)
Skin surface area (cm ²)	Avg.	1,725 cm ² (21)	1,940 cm ² (22)	1,725 cm ² (21)	1,940 cm ² (22)	2,530 cm ² (23)	1,725 cm ² (21)	1,940 cm ² (22)	1,825 cm ² (30)	5,000 cm ² (30)
	RME	2,500 cm ² (24)	2,490 cm ² (25)	2,500 cm ² (24)	2,490 cm ² (25)	3,665 cm ² (26)	2,500 cm ² (24)	2,490 cm ² (25)	1,825 cm ² (29)	5,000 cm ² (28)
Averaging time 1 - noncarcinogenic effects (days)	Avg./RME	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED
Averaging time 2 - carcinogenic effects (days)	Avg./RME	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70

References and Justifications:

- (1) Dermal Exposure Assessment, Principles and Applications - Interim Report (EPA, 1992).
- (2) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a).
- (3) Child is assumed to visit playground 5 days per week, 50 weeks per year.
- (4) Military family member is assumed to stay continuously at billeting area.
- (5) Maintenance is assumed to occur once per week.
- (6) Child is assumed to use ballpark 3 times per week for 16 weeks (4 months) per year.
- (7) Child is assumed to be in daycare with same frequency as a typical adult is at work - Standard Default Exposure Factors (EPA, 1991b).
- (8) Standard Default Exposure Factors (EPA, 1991b).
- (9) Child is assumed to use playground over a 3-year period.

**Table 2a. Exposure Equations and Assumptions for Dermal Exposure
Langley Air Force Base (Continued)**

- (10) Typical stay in billeting area does not exceed 1 month.
- (11) Exposure Factors Handbook - Review Draft (EPA, 1995).
- (12) Child is assumed to use ballfield over a 3-year period.
- (13) Child is assumed to attend daycare center for 3 years.
- (14) Average estimate of duration of excavation activity during construction is approximately 2 weeks.
- (15) Child is assumed to use playground over a 5 year period.
- (16) Conservative estimate of maximum duration of stay in billeting area is 3 months.
- (17) Child is assumed to use ballfield over a 5 year period.
- (18) Child is assumed to attend daycare center for a 5 year period.
- (19) Conservative estimate of duration of excavation activity during construction is slightly over 2 months.
- (20) Exposure Factors Handbook (EPA, 1989a), body weight for child between ages of 9 and 12.
- (21) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), exposed skin surface area for a child wearing shorts and a short sleeve shirt - assumes only lower leg is exposed.
- (22) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), exposed skin area for typical adult - hands and forearms (mean value).
- (23) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), exposed skin surface area for child (age 9-12) - hands, arms, and part of lower leg.
- (24) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), exposed skin surface area for a child wearing shorts and a short-sleeve shirt.
- (25) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), exposed skin area for typical adult - hands and forearms.
- (26) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), exposed skin surface area for child (age 9-12) - hands, arms, and lower legs.
- (27) Risk-based Concentration Table, October 1999, EPA Region III, Philadelphia, PA on-line .
- (30) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), default skin surface area for adult resident.
- (29) Interim Guidance for Dermal Exposure Assessment (EPA, 1991a), default skin surface area for child resident.
- (30) Values agreed to for use in resident receptor risk assessments at Langley AFB.

**Table 2b. Exposure Equations and Assumptions for Ingestion Exposure
Langley Air Force Base**

The incidental ingestion intake of chemicals in surface and subsurface soil was generated using the following equation:

$$\text{Intake(mg/kg/day)} = \frac{C \times IR \times 10^{-6} \times FI \times EF \times ED}{BW \times AT}$$

where:

C	=	Representative concentration of the contaminant in soil (mg/kg)
IR	=	Soil ingestion rate (mg/events)
FI	=	Fraction ingested from the contamination source (unitless)
EF	=	Exposure frequency (events/yr)
ED	=	Exposure duration (yrs)
BW	=	Receptor body weight (kg)
AT	=	Averaging period (days)
10 ⁶	=	Conversion factor (kg/mg)

The input variables that were used to estimate the ingestion exposure to each potential receptor, along with the justification for their use, are provided below.

Input Parameter		Child at Playground	Adult in Billeting Area	Child in Billeting Area	Maintenance Worker	Child Ballplayer	Child in Daycare	Construction Worker	Child Resident	Adult Resident
Ingestion rate (IR)	Avg.	100 mg/event (1)	50 mg/event (2)	100 mg/event (1)	50 mg/event (2)	165 mg/event (3)	100 mg/event (1)	480 mg/event (4)	100 mg/event (1)	50 mg/event (2)
	RME	200 mg/event (4)	100 mg/event (4)	200 mg/event (4)	100 mg/event (4)	200 mg/event (4)	200 mg/event (4)	480 mg/event (4)	200 mg/event (4)	100 mg/event (4)
Exposure frequency (EF)	Avg./RME	250 events/ year (5)	365 events/ year (6)	365 events/ year (6)	52 events/ years (7)	48 events/ years (8)	250 events/ year (9)	250 events/ year (4)	350 events/ year (13)	350 events/ year (13)
Exposure duration (ED)	Avg.	3 years (10)	0.08 years (11)	0.08 years (11)	5 years (12)	3 years (13)	3 years (14)	0.04 years (15)	1.8 years (26)	9 years (26)
	RME	5 years (16)	0.25 years (17)	0.25 years (17)	25 years (4)	5 years (18)	5 years (19)	0.2 years (20)	6 years (26)	24 years (26)
Body Weight (kg)	Avg./RME	15 kg (4)	70 kg (4)	15 kg (4)	70 kg (4)	36 kg (21)	15 kg (4)	70 kg (4)	15 kg (4)	70 kg (4)
Fraction ingested	Avg.	0.5 (22)	0.5 (22)	0.5 (22)	0.125 (23)	0.5 (22)	0.5 (22)	0.5 (22)	1.0 (27)	1.0 (27)
	RME	1.0 (24)	1.0 (24)	1.0 (24)	0.25 (25)	1.0 (24)	1.0 (24)	1.0 (24)	1.0 (27)	1.0 (27)
Average time 1 - noncarcinogenic effects (days)	Avg./RME	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED	365 days x ED
Average time 2 - carcinogenic effects (days)	Avg./RME	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x 70	365 days x ED	365 days x ED

References and Justifications:

- (1) Exposure Factors Handbook; Review Draft (EPA, 1995), mean value for children under 6 years of age.
- (2) Exposure Factors Handbook; Review Draft (EPA, 1995), mean value for adults.
- (3) Exposure Factors Handbook; Review Draft (EPA, 1995), mean value for active children.
- (4) Standard Default Exposure Factors (EPA, 1991b).
- (5) Child is assumed to visit playground 5 days per week, 50 weeks per year.
- (6) Military family member is assumed to stay continuously at billeting area.

**Table 2b. Exposure Equations and Assumptions for Ingestion Exposure
Langley Air Force Base (Continued)**

- (7) Maintenance is assumed to occur once per week.
- (8) Child is assumed to use ballpark 3 times per week for 16 weeks (4 months) per year.
- (9) Child is assumed to be in daycare with same frequency as a typical adult is at work - Standard Default Exposure Factors (EPA, 1991b).
- (10) Child is assumed to use playground over a 3-year period.
- (11) Typical stay in billeting area does not exceed 1 month.
- (12) Exposure Factors Handbook, Review Draft (EPA, 1995).
- (13) Child is assumed to use ballfield over a 3-year period.
- (14) Child is assumed to attend daycare center for 3 years.
- (15) Average estimate of duration of excavation activity during construction is approximately 2 weeks.
- (16) Child is assumed to use playground over a 5. year period.
- (17) Conservative estimate of maximum. duration of stay in billeting area is 3 months.
- (18) Child is assumed to use ballfield over a 5. year period.
- (19) Child is assumed to attend daycare center for a 5. year period.
- (20) Conservative estimate of duration of excavation activity during construction is slightly over 2 months.
- (21) Exposure Factors Handbook (EPA, 1989a), body weight for child between ages of 9 and 12.
- (22) Average FI was assumed to be 0.5.
- (23) Average FI for maintenance worker.
- (24) Maximum FI value was used.
- (25) Reasonable maximum FI for maintenance worker.
- (26) Values agreed for use in residential receptor risk assessments at Langley AFB.
- (26) Values agreed for use in residential receptor risk assessments for soil at Site OT-06.

**Table 2c. Exposure Equations and Assumptions for Inhalation Exposure
Langley Air Force Base**

The inhalation intake of chemicals that have sorbed onto particulate matter suspended in the ambient air was generated using the following equation:

$$\text{Intake (mg/kg/day)} = \frac{C \times IR \times ET \times EF \times ED}{BW \times AT}$$

where:

C	=	Contaminant concentration in air (mg/m ³)
IR	=	Inhalation rate (m ³ /hr)
ET	=	Exposure time (hrs/day)
EF	=	Exposure frequency (days/yr)
ED	=	Exposure duration (yrs)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

The input variables that were used to estimate the inhalation exposure to a potential construction worker, along with the justification for their use, are provided below. The construction worker is the only receptor for which the inhalation pathway is evaluated quantitatively because no chemicals of concern were identified for other potential receptors.

Input Parameter		Construction Worker
Inhalation rate (IR)	Avg./RME	0.83 m ³ /hour (1)
Exposure time (ET)	Avg./RME	8 hours (2)
Exposure frequency (EF)	Avg./RME	250 days/year (1)
Exposure duration (ED)	Avg.	0.04 years (3)
	RME	0.2 years (4)
Body weight (BW)	Avg./RME	70 kg (1)
Averaging time 1 - noncarcinogenic effects (days)	Avg./RME	356 days x ED
Averaging time 2 - carcinogenic effects (days)	Avg./RME	365 days x 70

References and Justifications:

- (1) Standard Default Exposure Factors (EPA, 1991 b).
- (2) Typical workday is assumed to be 8 hours.
- (3) Average estimate of duration of excavation activity during construction is approximately 2 weeks.
- (4) Conservative estimate of duration of excavation activity during construction is slightly over 2 months.

Table 3**Summary of Chemicals of Potential Concern - OT-06 Human Health**

Medium	Chemicals of Concern	Concentration Detected		Units	Frequency of Detection
		Min	Max		
OT-06 Surface Soil	Mercury	*BDL	7.95	mg/kg	131/131
	Dieldrin	0.289	23,400	mg/kg	121/131
OT-06 Subsurface Soil	Dieldrin	0.0011	11,000	ug/kg	85/121

**Table 4. Human Health Risk Assessment Summary for OT-24 (Site OT-06 and OT-06 Annex)
Langley Air Force Base**

	Child at Playground	Adult in Billeting Area	Child in Billeting Area	Maintenance Worker	Child Ball Players	Child at Daycare	Construction Worker	Child Resident (1)	Adult Resident (1)
OT-06 Noncancer Hazard Index	0.5	0.1	0.8	0.01	0.05	0.6	0.2	0.7* (2)	0.3
OT-06 Cancer Risk	2×10^{-5}	2×10^{-5}	6×10^{-5}	6×10^{-6}	6×10^{-6}	2×10^{-6}	5×10^{-7}	3.8×10^{-5}	3.5×10^{-5}
OT-06 Annex Noncancer Hazard Index	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	0.5	0.2
OT-06 Annex Cancer Risk	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

1) Residential risk was based on exposure to subsurface soil. A separate analysis was performed which indicated risk due to exposure to surface soil was not significant.

2) Based on impact to primary target organ. Total HI without consideration of target organs was 1.1.

APPENDIX B

Figures

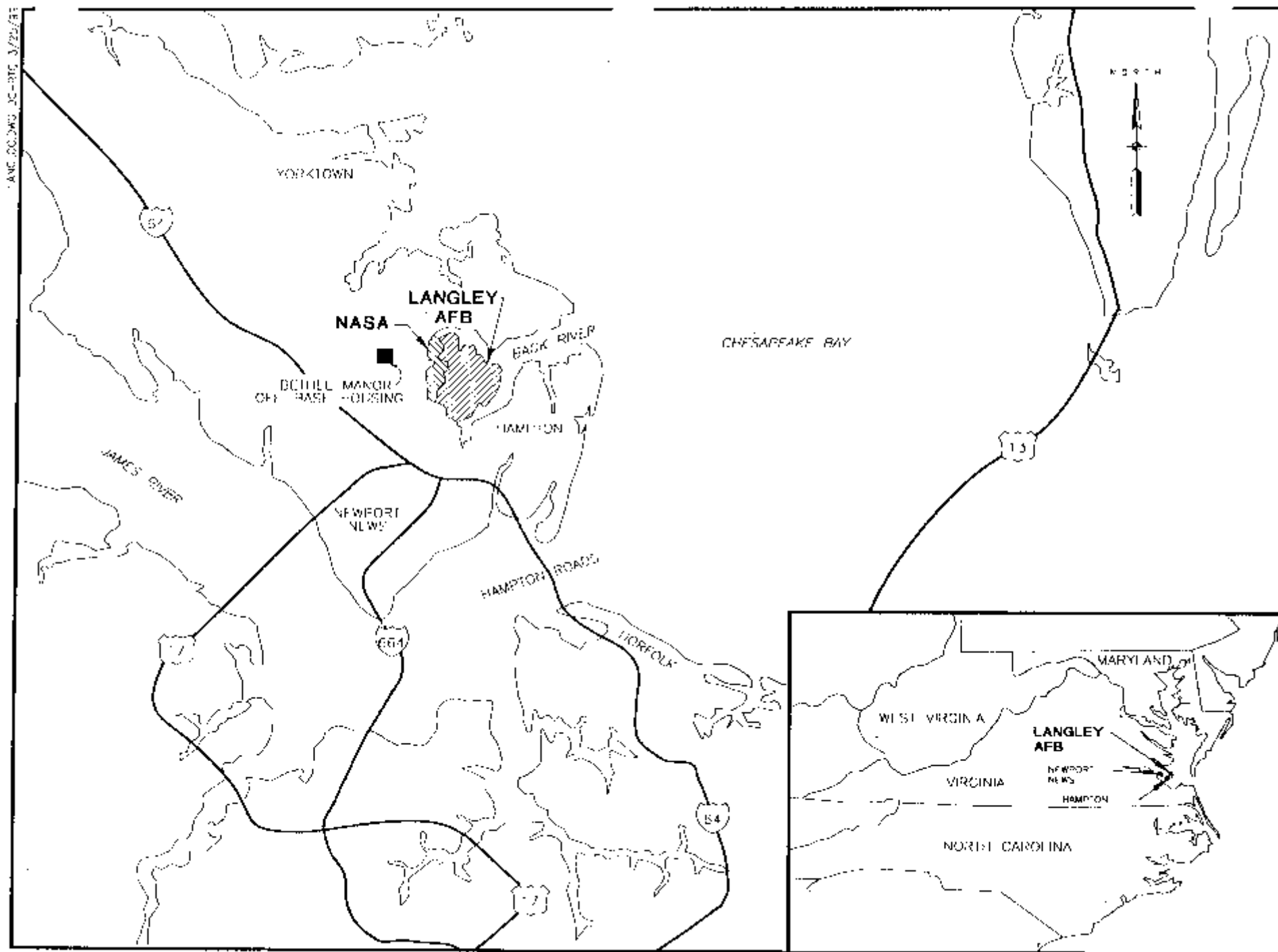


Figure 1. Location Map, Langley Air Force Base, Virginia

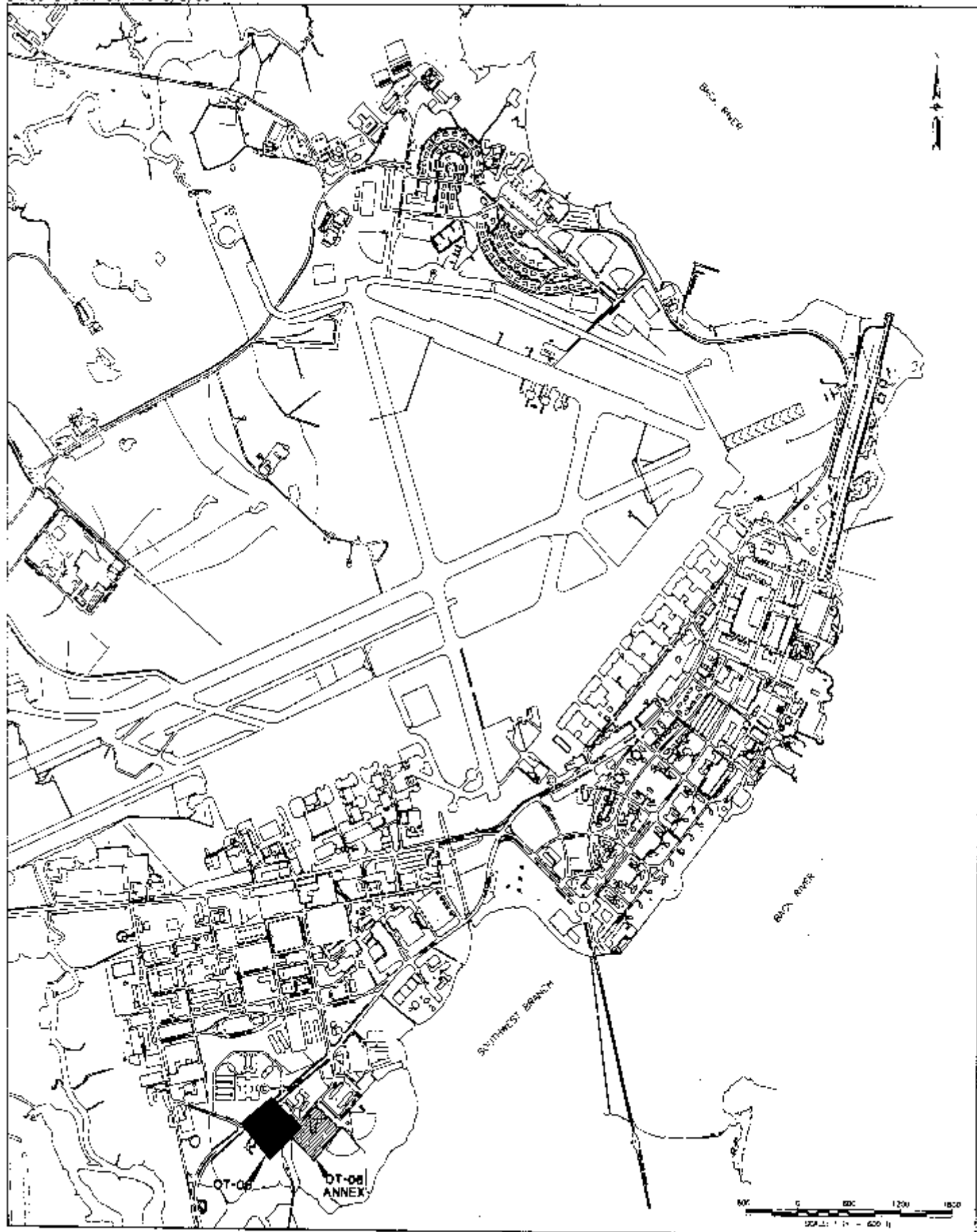


Figure 2. Location of OT-06 and OT-06 Annex at Langley AFB

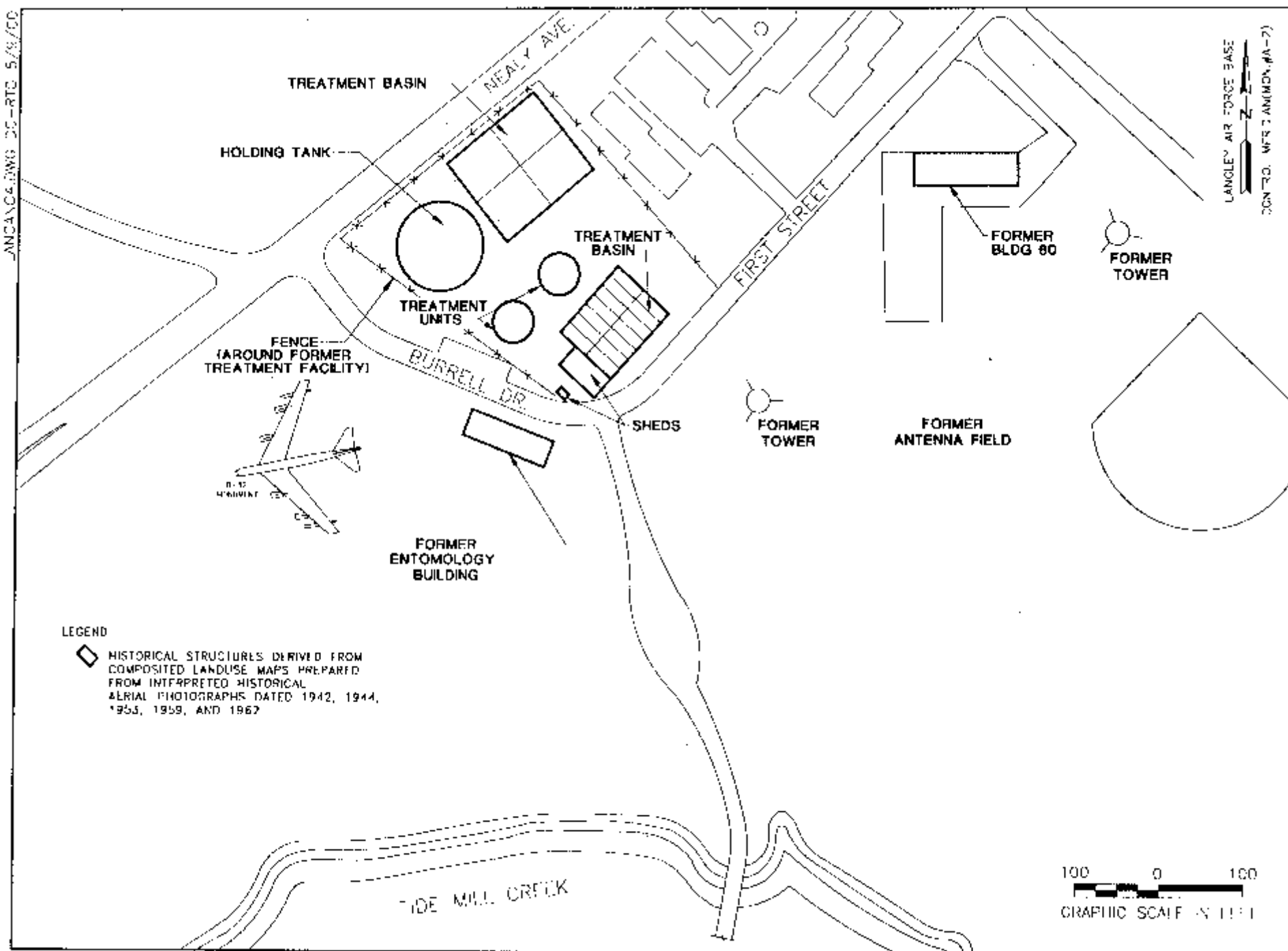


Figure 3. Historical Land Use Map, Site OT-06 and OT-06 Annex, Langley Air Force Base

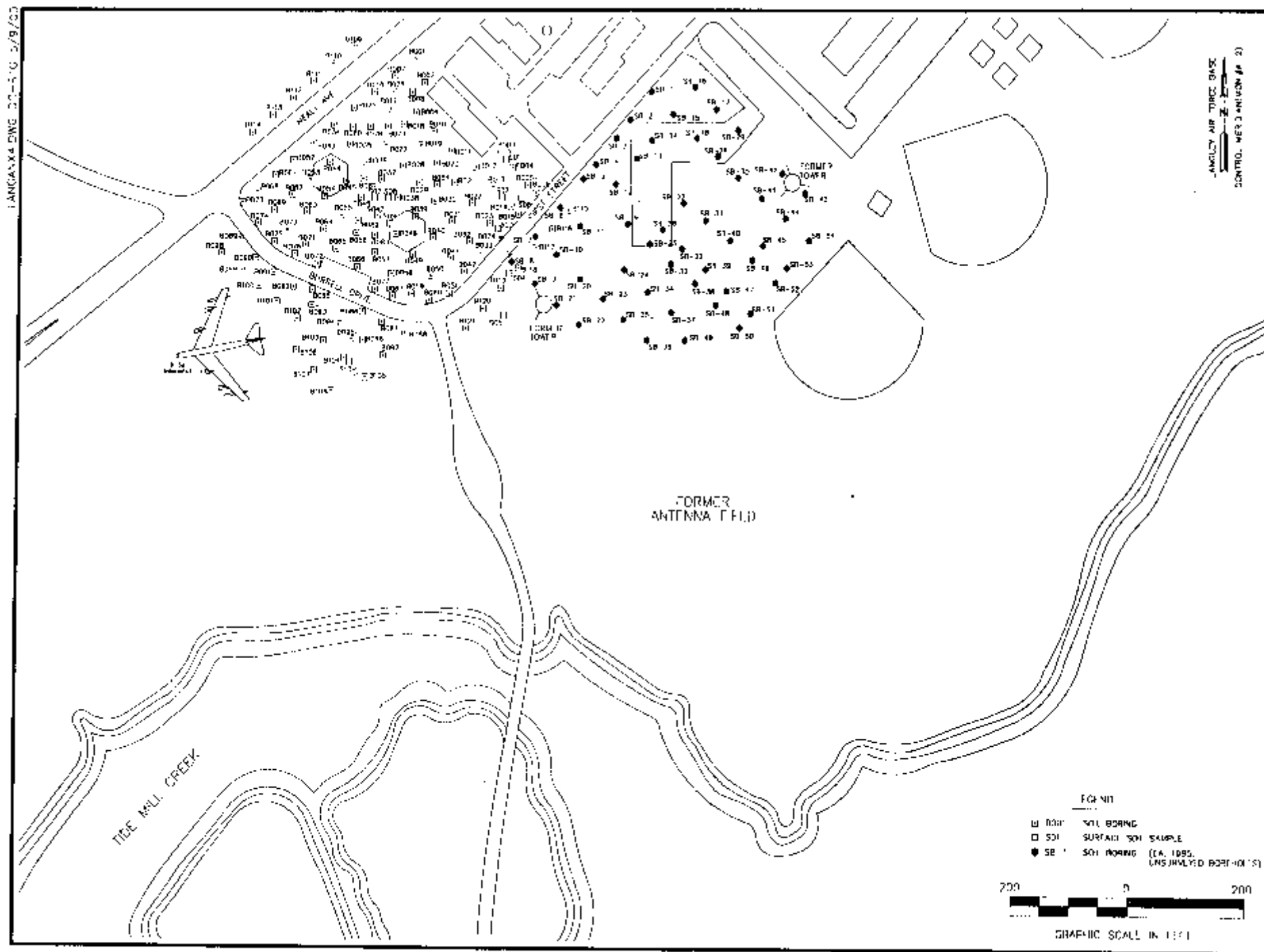
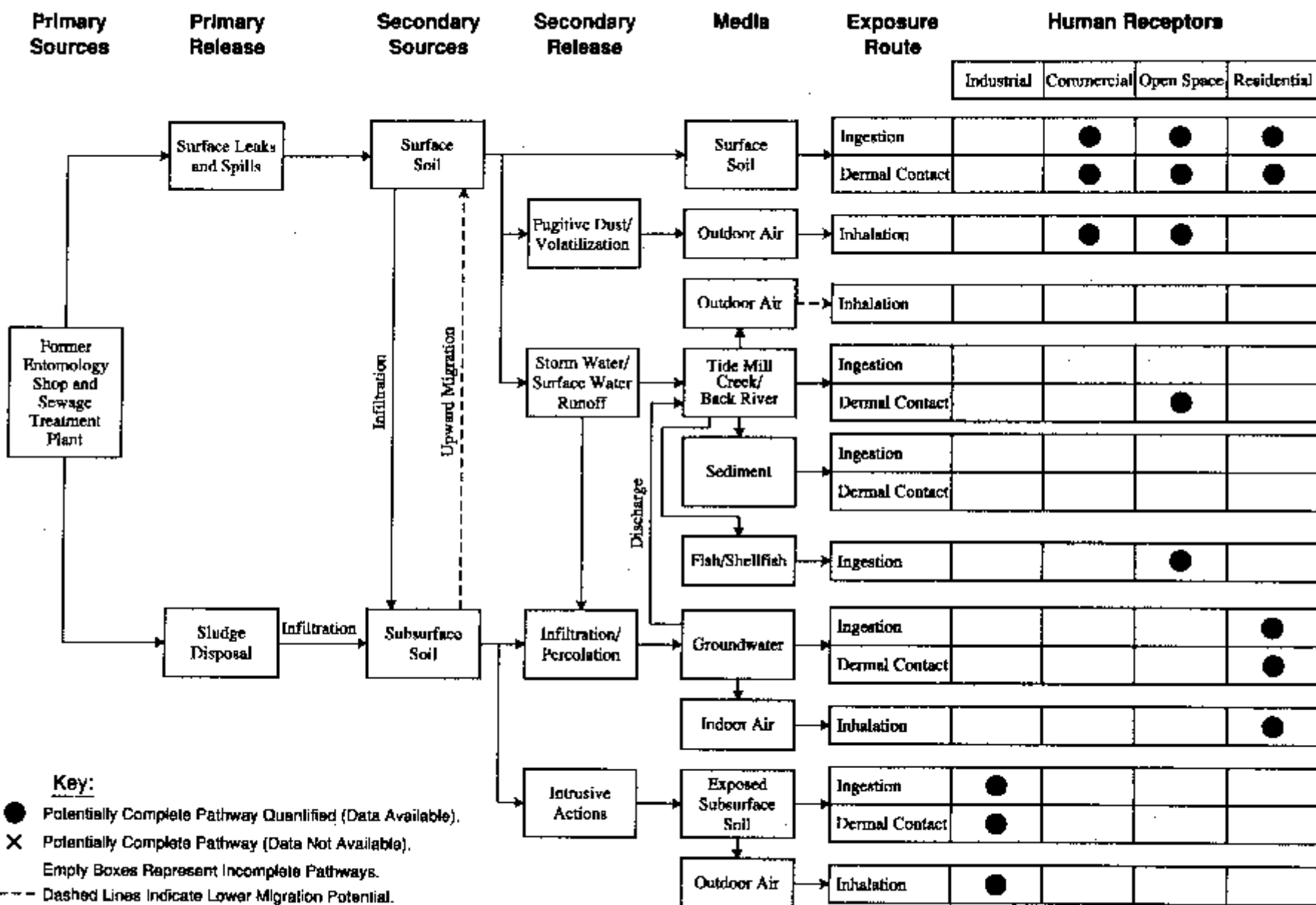


Figure 4. Soil Sampling Locations at Site OT-06 and OT-06 Annex, Langley Air Force Base

Site OT-06, Human Health Conceptual Site Model



**Figure 5a. Site OT-06 Human Health Conceptual Site Model
Langley Air Force Base**

Site OT-06 Annex, Human Health Conceptual Site Model

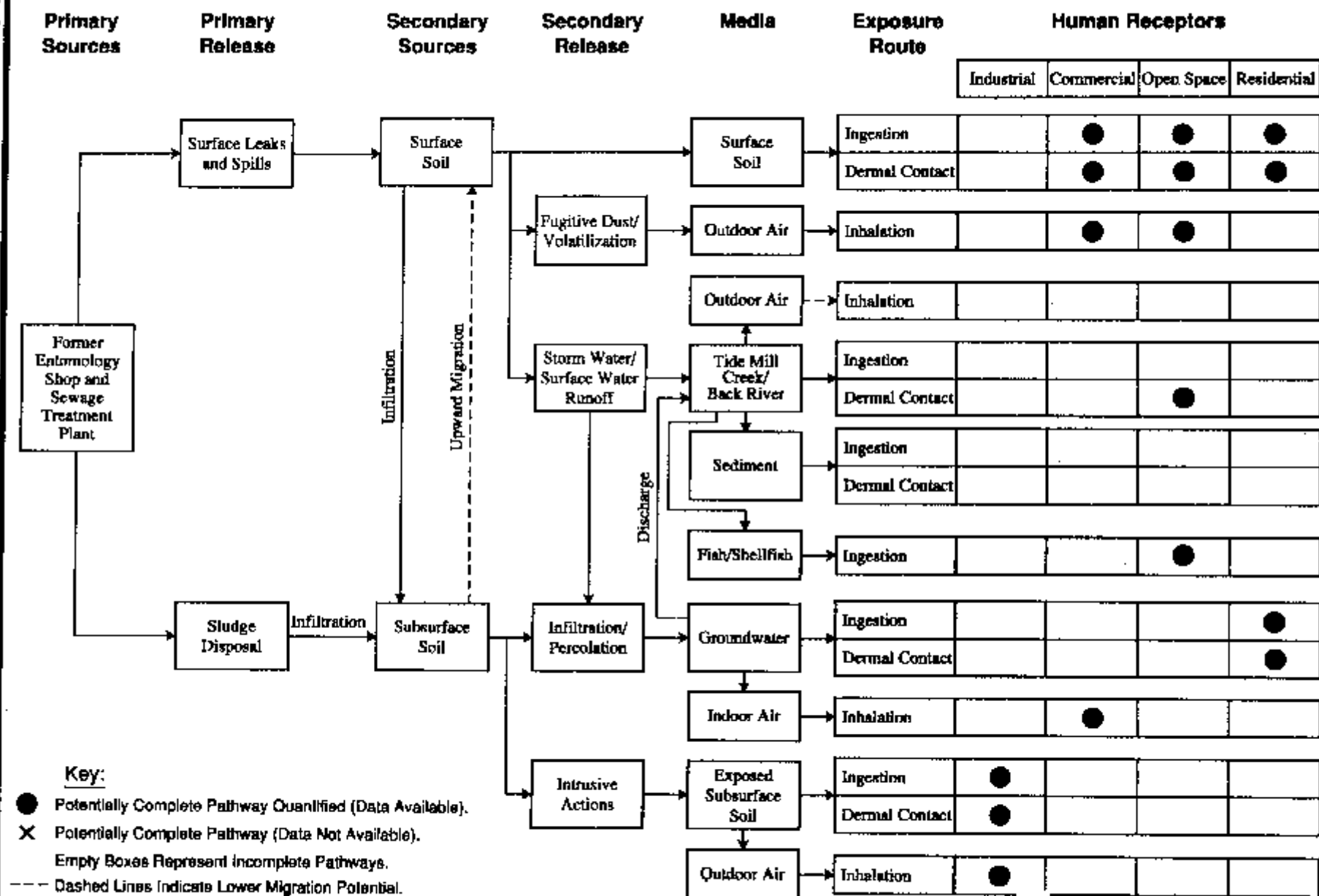
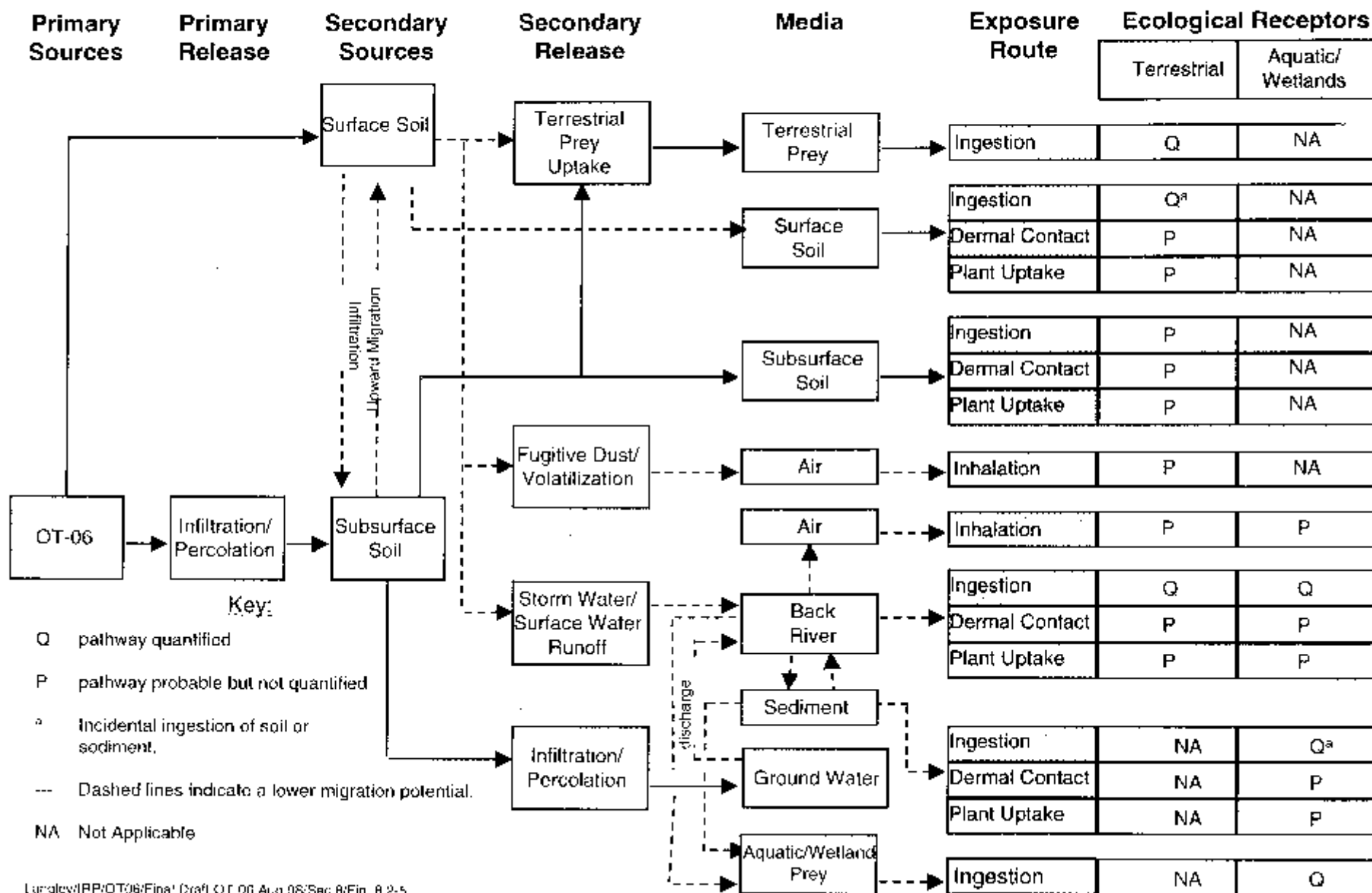


Figure 5b. Site OT-06 Annex Human Health Conceptual Site Model
Langley Air Force Base

Figure 6

**Ecological Conceptual Site Model
IRP Site OT-06
Langley Air Force Base, Virginia**



APPENDIX C

Glossary

Administrative Record: A collection of documents containing all the information and reports generated during the entire phase of investigation and cleanup at the site and used to make a decision on the selection of the preferred alternative under CERCLA.

Carcinogenic Risk: Cancer risks are expressed as numbers reflecting the increased chance that a person will develop cancer if exposed to chemicals or substances. For example, EPA's acceptable risk range for Superfund sites is 1×10^{-4} to 1×10^{-6} . This means that the probability of cancer should not be greater than 1 in 10,000 chance to a 1 in 1,000,000 chance above background.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A federal law, commonly referred to as the Superfund Program, passed in 1980 that provides for the cleanup and emergency response in connection with numerous existing inactive hazardous waste disposal sites that endanger public health and safety of the environment.

Chemicals of Potential Concern (COPCs): Chemicals, either present at the site as a result of historical activities or of likely concern to human health and the environment, which are evaluated in the risk assessment.

Ecological Risk Assessment: An evaluation of the risk posed to the environment if remedial activities are not performed at the site.

Environmental Restoration Program (ERP): Formerly known as the Installation Restoration Program (IRP).

Exposure Pathways: Describes the course a chemical or physical agent takes from the source to the exposed individual. Elements of the exposure pathway are: (1) the source of the released chemical; (2) the contaminated medium (e.g., soil); (3) a point of contact with the contaminated medium; and (4) an exposure route (e.g., ingestion, inhalation) at a contact point.

Hazard Index (HI): A number indicative of non-carcinogenic health effects which is the ratio of the existing level of exposure to an acceptable level of exposure. A value equal to or less than one indicates that the human population is not likely to experience adverse effects.

Human Health Risk Assessment (HHRA): An evaluation of the risk posed to human health should remedial activities not be implemented.

Installation Restoration Program (IRP): Program established by the United States Air Force to systematically identify and remediate contaminated sites. The IRP was designed to be consistent with EPA rules and guidelines.

Operable Unit (OU): A discrete portion of a site or a discrete action representing an incremental step in the investigation and remediation of hazardous substances at a facility.

Proposed Plan: A document that presents a proposed cleanup alternative and requests public input regarding the proposed alternative.

Record of Decision (ROD): A legal document that describes the cleanup action or remedy selected for a site, the basis for the choice of that remedy, and public comment on alternative remedies.

Remedial Investigation (RI): Part of a study of a facility that supports the selection of a remedy for a site where hazardous substances have been disposed. The RI identifies the nature and extent of contamination at the facility.

Site: The facility and any other areas in close proximity to the facility where a hazardous substance, hazardous waste, hazardous constituent, pollutant, or contaminant from the facility has been deposited, stored, disposed of, or placed or has migrated or otherwise come to be located.

Site Inspection (SI): The SI determines if the site presents an immediate threat that requires prompt response action because the site may pose a threat to human health and/or the environment.

Site-Related Risk: Cancer and non-cancer risk estimates that are based on contaminants present in environmental media due to site-specific human activities at Langley AFB, but that exclude the contribution of background contaminant concentrations.

Superfund Amendments and Reauthorization Act (SARA): An amendment to CERCLA enacted in 1986.

APPENDIX D

References

¹*Remedial Investigation Report for Site OT-06 and OT-06 Annex*, (final), Langley Air Force Base, Virginia. Radian International LLC, October, 1999.

²*Installation Restoration Program Records Search for Langley Air Force Base, Virginia*. Gainesville, Florida. CH2M Hill, June 1981.

³*Installation Restoration Program (IRP) Site Inspection and Screening Risk Assessment Report for 33 IRP Sites* (draft). Radian Corporation, February 1996.

⁴*No Action Proposed Plan for: OU-24 (OT-06 and OT-06 Annex), Langley Air Force Base* (final). Langley AFB, May 2000.

⁵*Installation Restoration Program (IRP) Conceptual Hydrogeological Model Report* (final), Radian International LLC, May 1998.

⁶*Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual*. OSWER Directive 9285.7-01a, Office of Emergency and Remedial Response, Washington, D.C. U.S. Environmental Protection Agency, 1989.

⁷*Installation Restoration Program (IRP) Background Chemical Data Document* (final). Radian International LLC, May 1997.